MULTIMEDIA UNIVERSITY®

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2018/2019

ECP2056 – DATA COMMUNICATIONS AND COMPUTER NETWORKING

(BE/RE/TE)

16 OCTOBER 2018
2:30 p.m. – 4:30 p.m.
(2 Hours)

INSTRUCTION TO STUDENTS

1. This Question paper consists of 5 pages including cover page with 4 Questions only.

2. Attempt **ALL** questions. All questions carry equal marks and the distribution of marks for each question is given.

3. Please write all your answers in the Answer Booklet provided.

Question 1

(a) A network is two or more devices connected through links. A link is a communications pathway that transfers data form one device to another.

(i) State **Two (2)** types of connections.

[2 marks]

(ii) State **Four (4)** basic network topologies and categorise them in terms of types of connections.

[8 marks]

(b) Open Systems Interconnection (OSI) model is an ISO standard that covers all aspects of network communications. Transmission Control Protocol/Internet Protocol (TCP/IP) model also is a layered protocol but does not use all of the OSI layers. Draw a diagram to show the correlation between the layers of the OSI model and the layers of the TCP/IP model.

[9 marks]

(c) Four levels of addresses are used in an internet employing the TCP/IP models: physical, logical, port, and specific. What is the difference between a physical address, a logical address, and a port address?

[6 marks]

Question 2

(a) Given that 2,500 characters are to be transmitted asynchronously using 7-bit American Standard Code for Information Interchange (ASCII) coding. Assume 1 start bit, 2 stop bits and 1 even parity bit for each character.

(i) What is the minimum number of extra bits needed?

[3 marks]

(ii) What is the efficiency to transmit useful information in percentage?

[4 marks]

(b) Signals travel through transmission media, which are not perfect. The imperfection causes signal impairment. What are the **Three (3)** causes of impairment?

[3 marks]

(c) A message with 150,000 characters is to be transmitted through a channel with spectrum between 1,500 Hz and 4,500 Hz. Each character is encoded using 7-bit ASCII code with 1 odd parity bit. Assume using asynchronous communication with 1 start bit and 2 stop bits for each character. Calculate the duration of transmission if the message is transmitted at maximum available rate:

(i) Using a transmission scheme with 8 levels per signalling element and the channel is noiseless.

[5 marks]

Continued...

(ii) Through a channel that has a typical signal-to-noise ratio of 32 dB.

[3 marks]

(iii) Using a 2,400-baud QAM modem that is able to produce 16 signalling states.

[3 marks]

(d) Given that a data channel occupies a bandwidth of 3 MHz and total bandwidth of a multiplexed signals is 54 MHz. Assume that 16 channels have been multiplexed with guard bands. Guard bands are needed between the channels to prevent interference. Calculate the available bandwidth for each of these guard bands.

[4 marks]

Question 3

(a) An organization is granted a block of addresses with the beginning address 18.28.78.0/24. The organisation needs to have 3 subblocks of addresses to use in its three subnets: one subblock of 12 addresses, one subblock of 63 addresses, and one subblock of 124 addresses.

(i) Design the subblocks by specifying the subnet addresses and the range of addresses for each subnet.

[9 marks]

(ii) Find out how many addresses are still available after these allocations.

[2 marks]

(b) The fourth version of Internet Protocol, IPv4 was first developed in the 1970s. With the unprecedented expansion of Internet usage, address depletion or shortage of address space was recognized in year 1992. This is a serious limiting factor to the continued usage of the Internet run on IPv4. Besides address depletion, briefly explain two more deficiencies of IPv4.

[4 marks]

(c) Define fragmentation in Internet Protocol. Explain the reason for IPv4 and IPv6 protocols need to fragment some packets. State the difference between these two protocols in this matter.

[2 + 2 + 2 marks]

(d) For a Transmission Control Protocol (TCP) congestion control, given that the original congestion window (cwnd) size and slow-start threshold at $t = 0$ are 1 and 16 respectively. A packet lost is detected when the cwnd is 8 for the first time. If the round-trip time is constant at 200 *ms*, determine the total time taken (from $t = 0$) for the congestion window size to become 30.

[4 marks]

Continued...

Question 4

(a) Wireless LANs is one of the fastest-growing technologies. IEEE has defined the specifications for wireless LANs, called IEEE 802.11.

(i) The CSMA/CD algorithm does not work in wireless LANs. Stations on wireless LANs normally use CSMA/CA. Describe the differences between CSMA/CD and CSMA/CA.

[4 marks]

(ii) IEEE 802.11 defines two kinds of services: basic service set (BSS) and extended service set (ESS). Describe the differences between a BSS and an ESS.

[4 marks]

(b) Figure Q4.1 shows a collision of the first bit in CSMA/CD. Given that the data rate is 100 Mbps, distance between station A and station C is 3,000 m, and the propagation speed is 2×10^8 m/s. The size of frame is long enough to guarantee the detection of collision by both stations. Station A starts sending a frame at time $t_1 = 0$. Station C starts sending a frame at time $t_2 = 3$ μs.

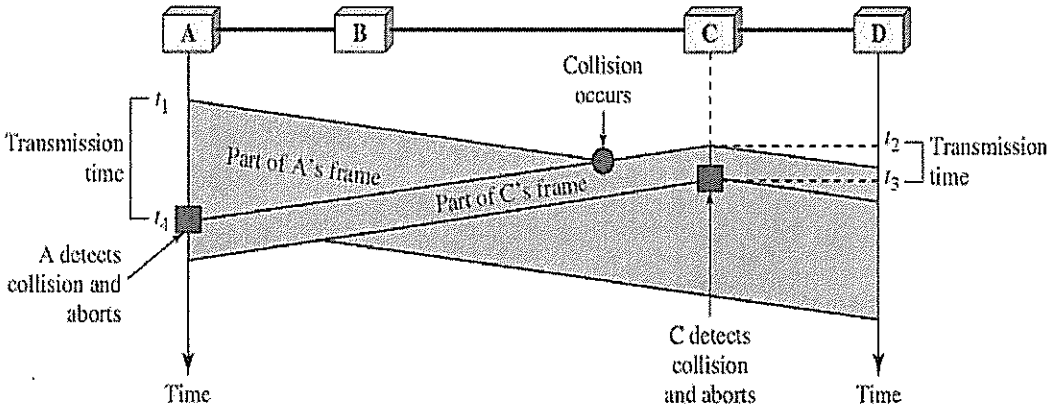

Figure Q4.1

Find:

(i) The time when station C hears the collision (t_3).

[2 marks]

(ii) The time when station A hears the collision (t_4).

[2 marks]

(iii) The number of bits that station A has sent before detecting the collision.

[2 marks]

(iv) The number of bits that station C has sent before detecting the collision.

[2 marks]

Continued...

(c) A series of packets are to be transmitted to the same destination using 7-bit sequence numbers. The sequence number starts with 0. Determine:

(i) Range of the sequence numbers.

[1 mark]

(ii) The sequence number after sending 400 packets.

[2 marks]

(iii) The maximum sizes of the send and receive windows for Stop-and-Wait ARQ.

[2 marks]

(iv) The maximum sizes of the send and receive windows for Go-Back-*N* ARQ.

[2 marks]

(v) The maximum sizes of the send and receive windows for Selective-Repeat ARQ.

[2 marks]

End of Paper